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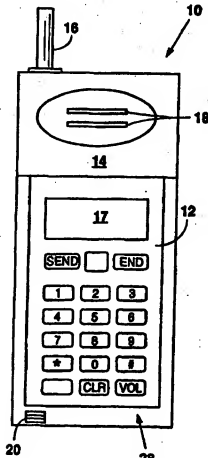
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## TELECOMMUNICATION APPARATUS HAVING DUAL KEYPADS

## BACKGROUND OF THE INVENTION

Technical Field

5 This invention relates generally to portable telecommunication instruments, and more particularly to a dual keypad arrangement for such instruments.

History of Related Art

10 Manually operable keypads are commonly used in telecommunication instruments such as cellular telephones and radios, personal-digital assistants (PDA) personal organizers and cellular phone combinations, and similar transmitting and receiving instruments. In many  
15 applications, it is desirable to have a large number of keys to provide a wide variety of separate input signals. For example, in many applications it is desirable to have a full English alphabet character input requiring 26 keys, and additional keys for punctuation marks. If the  
20 telecommunication instrument is adapted for the Japanese market, about 60 keys are required for Japanese Kanji characters. The increasing need for additional keys requires additional space on the instrument for the keypad array. However, it is desirable to keep the instrument  
25 as small as possible so that it can easily be held in the hand, or even carried in a pocket, of the user.

The present invention is directed to overcoming the above problems. It is desirable to have a  
30 telecommunication instrument that provides for many more keyed input signals than is available with the single keypad commonly used on cellular phones and the like. It is also desirable to have a telecommunication instrument that provides for additional keyed input signals without increasing the overall size of the instrument.

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### SUMMARY OF THE INVENTION

In accordance with one aspect of the present invention, a telecommunication instrument comprises a housing and a cover pivotally attached to the housing. The cover is movable between a closed position at which the cover overlays a predefined portion of the housing and an open position at which the cover is spaced from the predefined portion of the housing. The cover also includes a first keypad disposed on the first surface of the cover that is operable only when the cover is in the closed position, and a second keypad disposed on a second surface of the cover that is operable only when the cover is in the open position.

Other features of the telecommunication instrument embodying the present invention include at least one of the first and second keypads being a substantially flat membrane keypad having a plurality of separately defined touch sensitive areas disposed on the keypad. Other features include at least one of the first and second keypad being a plurality of touch sensitive keys, each of which provide tactile feedback to an operator of the keypad. Still other features of the telecommunication instrument embodying the present invention include the instrument having a means for sensing the respective open and closed positions of the cover.

### BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the structure and operation of the present invention may be had by reference to the following detailed description when taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a plan view of a telecommunication instrument embodying the present invention, showing the pivotable cover in a closed position;

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Fig. 2 is a plan view of the telecommunication instrument embodying the present invention, showing the pivotable cover in an open position;

Fig. 3 is a plan view of the telecommunication instrument embodying the present invention, showing an alternative attachment arrangement of the pivotable cover which is shown in an open position;

Fig. 4 is a schematic diagram showing a keypad switch matrix circuit of the telecommunication instrument embodying the present invention;

Fig. 5 is a schematic representation of a mechanically operable switch arrangement for providing a signal indicating the position of the cover;

Fig. 6 is a schematic representation of an alternative arrangement of a switch for providing a signal indicating the position of the cover; and

Fig. 7 is a schematic cross-sectional representation of the cover and housing showing a flexible cable connection between the two members.

#### DETAILED DESCRIPTION OF A PRESENTLY PREFERRED EXEMPLARY EMBODIMENT

A telecommunication instrument embodying the present invention is illustrated herein as a cellular telephone 10 having a movable cover 12 that is pivotably attached to a housing 14 comprising the main body of the instrument. The main body, or housing, 14 of the cellular telephone 10 typically provides support for an antenna 16 and an enclosure for electronic circuitry providing the signal processing required for operation of the instrument 10. Typically, the circuitry includes both RF signal processing circuits and keyboard logic decoding circuits. In the present invention for reasons described below in more detail,, the instrument 10 includes either two conventional logic decoding circuits, or a single circuit capable of operating in two modes, that is responsive to

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a signal representative of the open or closed position of the cover 12. In the illustrative embodiment, the cellular telephone 10 includes an LCD display screen 17 adapted to display received data and, in some applications, transmit data entered directly onto the screen 17. The housing 14 also has an opening 18 to provide transmission of audible signals from an internal speaker to a user, and openings 20 to provide transmission of audible signals from a user to an internal microphone.

In the preferred embodiment of the present invention, the flip cover 12 is pivotally attached to the housing 14 by hinges 22 disposed at one side of the cover 12 as shown in Fig. 2, or at the bottom of the cover as shown in Fig. 3. Typically, the housing 14 and the frame of the cover 12 are injection molded of a thermoplastic or thermoset plastic material such as ABS resins, cellulosic plastics, phenolic resins, phenylene oxide resins, polycarbonate, polyester, polystyrene, polyurethane, or polyvinyl chloride. The hinges 22 are thus integrally molded with the respective housing 14 and cover 12, and subsequently assembled by inserting a pin through both halves of the hinge or by the snap fit of one hinge with a mating portion of the other hinge. Desirably, the cover 12 also includes an opening 26, aligned with the slots 20 in the housing 14 when the cover 12 is closed, to provide for voice transmission to the microphone disposed in the housing 14. In the side opening arrangement shown in Fig. 2, the cover 12 also includes an opening 24 to provide visual observation of data displayed in a predesignated area of the LCD screen 17.

Importantly, the cover 12 contains two keypads. A first keypad 28 is disposed on an outer surface of the cover 12 when the cover is closed, and a second keypad 30 is disposed on the inner surface of the cover 12. In the preferred embodiment, the first keypad 28 is desirably formed of a plurality of touch-responsive keys, each of which provide a tactile feedback to the operator of the

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keypad. Keypads of this type are typically formed of silicone rubber with a conductive carbon pill attached to the bottom surface of each key. The conductive carbon element provides a switch that closes a circuit across a pair of contacts provided on an underlying printed circuit board 32.

In the preferred embodiment of the present invention, the second keypad 30 is a substantially flat membrane keypad having a plurality of separately defined touch sensitive areas. Keypads of this type are commonly used on thin "credit card" calculators and other keypad operated instruments that require a thin overall thickness. Thin membrane keypads typically have a flexible membrane cover which is imprinted with a plurality of characters. Under each of the characters, a thin conductor is shaped to span two contacts on an underlying printed circuit board. Depressing the membrane in the area of a particular character causes the underlying electrical conductor to complete a circuit across the associated contacts. In the illustrated embodiment, 60 separate areas are provided on the second keypad 30. The 60 areas are thus capable of providing a full English alphabet arrangement and associated punctuation characters, in addition to numeric characters 0-9 and additional function keys. If desired, the character display may be imprinted with Japanese Kanji characters, or other language characters. Typically, the membrane keypad does not provide a tactile feedback to the user, but generates a beeping sound when a specific key is depressed, thus providing an audible feedback signal. The thin membrane keypad is particularly suitable for operation on the inside surface of the cover 12 due to its substantially flat surface topography. A sectional view of the first and second keypads 28, 30 is shown, in somewhat schematic fashion, in Fig. 7.

Fig. 4 shows a diagram of the electrical circuit 34 associated with each of the keypads 28, 30. The lower



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area enclosed by dashed lines in Fig. 4 represents the portion of the electrical circuit supporting the first keypad 28 and the upper area enclosed by dashed lines represents the electrical circuit supporting the second keypad 30. The electrical circuit is essentially an 8 x 8 matrix circuit (rows 1-8 and columns a-h) providing 64 switch contacts for the second keypad 30, although only 60 keys are actually used in the illustrative embodiment. It is desirable to provide separate input circuits for the first and second keypads 28,30 to avoid signal interference resulting from the accidental actuation of a key on the first keypad 28 when using the second keypad 30. When using the second keypad 30, the first keypad 28 becomes the back cover and could be inadvertently pressed during use of the second keypad 30.

A separate switch on the printed circuit board 32 senses whether the cover 12 is in the open or closed position and, accordingly, which decoding logic circuit should be activated. In Fig. 5, the cover position switch is a simple mechanical switch 36 that is depressed by a tab 37 extending downwardly from the cover 12. The mechanically operative switch 36 is moved from a normally open position to a closed position in response to the cover 12 being moved from the open to the closed position. The switch 36 is thus activated when the cover 12 is in the closed position.

Alternatively, the cover position switch may comprise a reed switch 38 that is activated by a magnet 40 disposed in an aligned portion of the cover 12, as shown in Fig. 6. The reed switch 38 remains closed in the presence of the magnet 40, and is opened by movement of the cover 12 away from the closed position. Thus, the switches 36, 38 alternatively provide a means for sensing the respective open and closed position of the cover 12 and providing a signal to the logic decoding circuitry of the cellular phone 10 representative of the position of the cover 12.

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Desirably, the first keypad 28 may also include a plurality of light-emitting diodes (LEDs) 42, arranged under the first keypad 28 as shown in Fig. 7, to provide illumination of the keypad 28 under low light conditions. If desired, the membrane keypad may also be backlit by using the same LEDs 42 that provide illumination of the keys of the front, or first, keypad 30. This portion of the circuitry is also shown in the lower area enclosed by dashed lines in Fig. 4.

Communication of electrical signals between the first and second keypads 28, 30 disposed on the cover 12 and the keyboard logic circuitry of the phone 10 is provided by a flexible flat cable 44 having 21 leads disposed, typically in side-by-side relationship, within the cable 44. Two of the leads provide illumination of the LEDs 42, eight of the leads are connected to the columnar portion of the matrix circuit, represented by letters a-h in Fig. 4, and the remaining eleven leads are connected to rows 1-11 arrayed along the other axis of the matrix circuit in Fig. 4.

Thus, it can be seen that the cellular phone 10 embodying the present invention provides a telecommunication instrument having many additional keys, and alternate modes of operation, than provided by conventional single keyboard cellular telephones. Advantageously, the cellular telephone 10 does not require any significantly increased volumetric size than conventional cellular phones, and provides a convenient flip cover function, which many users find desirable as an extension of the telephone.

Although the present invention is described in terms of preferred exemplary embodiments, with specific illustrative construction and circuit arrangements, those skilled in the art will recognize that changes in those arrangements and constructions may be made without departing from the spirit of the invention. For example, the pivotally attached cover 12 may be constructed so that

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it is detachable from the housing 10 and the flexible cable 44 provided with connectors that enable the second keyboard 30 to be operated at a position remote from the housing 14 of the cellular phone 10. Such changes are intended to fall within the scope of the following claims. Other aspects, features and advantages of the present invention may be obtained from a study of this disclosure and the drawings, along with the appended claims.

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## WHAT IS CLAIMED IS:

1. A telecommunication instrument, comprising:  
a housing;

5 a cover pivotably attached to said housing and  
movable between a closed position at which said cover  
overlays a predefined portion of said housing and an open  
position at which said cover is spaced from said  
predefined portion of the housing, said cover having a  
10 first keypad disposed on a first surface of said cover and  
operable only when said cover is in the closed position  
and a second keypad disposed on a second surface of said  
cover and operable only when said cover is in the open  
position.

15 2. A telecommunication instrument, as set forth in  
Claim 1, wherein at least one of said first and second  
keypads comprises a substantially flat membrane keypad  
having a plurality of separately defined touch-sensitive  
20 areas disposed thereon..

25 3. A telecommunication instrument, as set forth in  
Claim 1, wherein at least one of said first and second  
keypads comprises a plurality of touch-responsive keys  
providing tactile feedback to an operator of said keypad.

30 4. A telecommunication instrument, as set forth in  
Claim 1, wherein said first keypad comprises a plurality  
of touch-responsive keys providing tactile feedback to an  
operator of said first keypad, and said second keypad  
comprises a substantially flat membrane keypad having a  
35 plurality of separately defined touch-sensitive areas  
disposed thereon.

5. A telecommunication instrument, as set forth in  
40 Claim 4, wherein said cover includes a plurality of light  
emitting diodes disposed under said first keypad and

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arranged to provide illumination of the keys comprising said first keypad.

5           6.    A telecommunication instrument, as set forth in Claim 1, wherein said instrument includes a means for sensing the respective open and closed positions of said cover.

10           7.    A telecommunication instrument, as set forth in Claim 6, wherein said means for sensing the respective open and closed positions of said cover includes a mechanically operative switch that is moved from a normally open position to a closed position in response to said cover being moved from the open to the closed  
15           position and is maintained at said closed position in response to said cover being disposed at said closed position.

20           8.    A telecommunication instrument, as set forth in Claim 6, wherein said means for sensing the respective open and closed positions of said cover includes a magnetic material disposed at a predetermined position on said cover and a magnetically operative switch disposed  
25           in said housing at a position aligned with the magnetic material in said cover when said cover is in the closed position.

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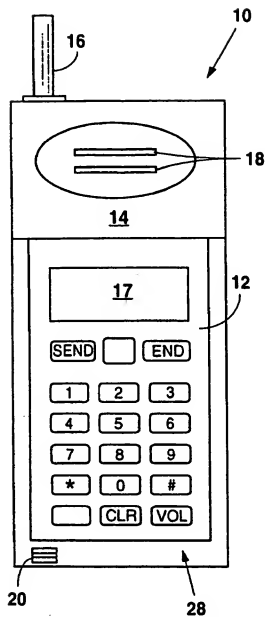


Fig. 1

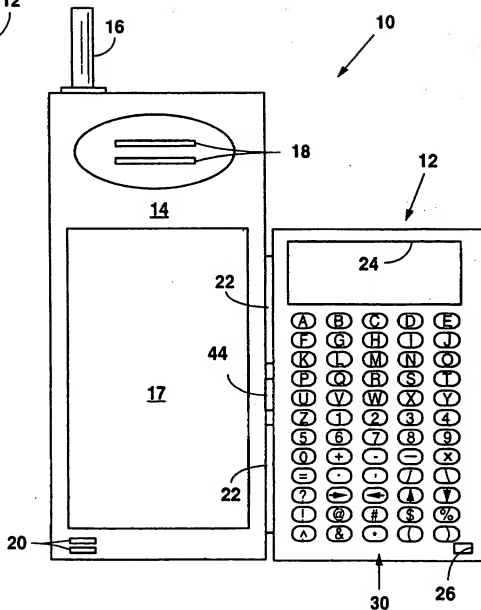


Fig. 2

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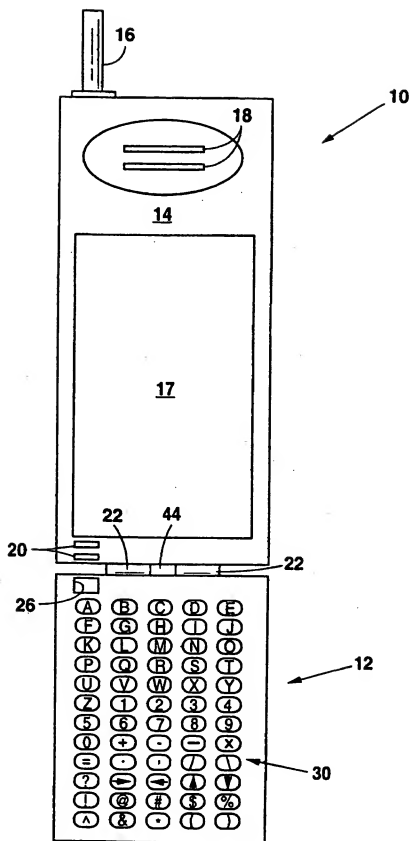


Fig. 3

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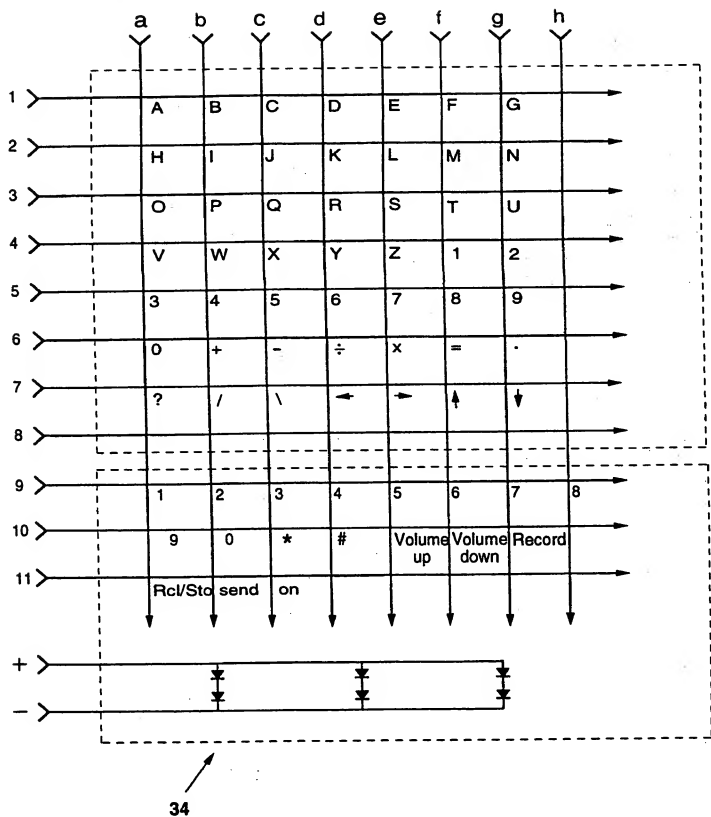


Fig. 4



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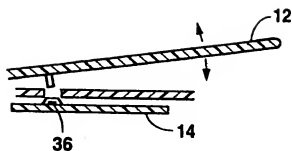


Fig. 5

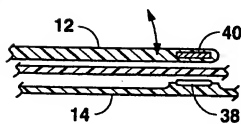


Fig. 6

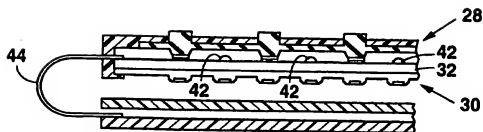


Fig. 7

I. International Application No  
PCT/US 97/19342

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Category *	Citation of documents appropriate, or the relevant passages	Relevant to claim No.
X	EP 0 534 478 A (CASIO COMPUTER CO LTD) 31 March 1993 see column 3, line 1 - column 4, line 22 see column 11, line 29 - column 12, line 36 see figures 1.3.4.9	1,6,7
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X	EP 0 678 987 A (NIPPON ELECTRIC CO) 25 October 1995 see column 3, line 23 - column 6, line 48; figures 1-6	1,6,7
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Int'l. Jona'l Application No  
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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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